

AMENDMENTS TO THE CLAIMS

1. (currently amended) A surface mount electronic device comprising an encapsulated integrated circuit mounted on a connecting substrate having a bottom surface, wherein the encapsulated integrated circuit mounted on a connecting substrate ~~surface mount electronic device~~ is attached to a printed circuit board utilizing a solid or semi-solid thermoplastic adhesive adhered to a portion of the bottom surface or to an available surface on the connecting substrate, wherein the thermoplastic adhesive has a complex viscosity of at least 50 Pa•s at a temperature from 140°C to 220°C inclusive at a shear rate of 0.1 radians per second, and wherein the thermoplastic adhesive is a solid or semi-solid at 55°C.

2. (cancelled)

3. (previously presented) The surface mount device of claim 1, wherein the surface mounted electronic device comprises a ball grid array.

4. (original) The surface mount device of claim 3, wherein the ball grid array is selected from the group consisting of μ BGA, flip chip BGA, a flex tape BGA, and stacked die BGA.

5. (previously presented) The surface mount device of claim 1, wherein the surface mounted electronic device comprises an integrated circuit having a function selected from the group consisting of flash memory, microprocessor, counter, and timer applications.

6. (previously presented) The surface mount device of claim 1, wherein the connecting substrate comprises a material selected from the group consisting of a polyimide, polyester, polycyclohexylene terephthalate, polyphenylene sulfides, and epoxy resin impregnated glass.

7. (cancelled)

8. (previously presented) The surface mount device of claim 1, wherein the surface mounted electronic device comprises a BGA having an array of solder bumps on said bottom surface of the connecting substrate, and the thermoplastic adhesive is applied as strips spanning the length of at least two perimeter edges on said bottom surface.

9. (previously presented) The surface mount device of claim 1, wherein the surface mounted electronic device comprises a BGA having an array of solder bumps on said bottom surface of the connecting substrate, and the thermoplastic adhesive is applied on each corner of the bottom surface.

10. (previously presented) The surface mount device of claim 1, wherein the surface mounted electronic device comprises a BGA having an array of solder bumps on said bottom surface of the connecting substrate, and the thermoplastic adhesive is applied as squares or rectangles between each of the four corners on the said bottom surface.

11. (previously presented) The surface mount device of claim 1, wherein the thermoplastic adhesive is attached to the connecting substrate by application of heat to the thermoplastic adhesive, the connecting substrate, or both, sufficient to render the thermoplastic adhesive tacky.

12. (previously presented) The surface mount device of claim 1, wherein the thermoplastic adhesive is adhered to the connecting substrate by application of heat to the thermoplastic adhesive, the connecting substrate, or both, laying down the thermoplastic adhesive on an available surface of the connecting substrate, followed by the application of pressure to the thermoplastic adhesive.

13. (previously presented) The surface mount device of claim 1, wherein the thermoplastic adhesive is adhered to the connecting substrate by application of pressure on the thermoplastic adhesive.

14. (previously presented) The surface mount device of claim 13, wherein a pressure sensitive adhesive is applied to the thermoplastic adhesive prior to adhering the thermoplastic adhesive to the connecting substrate, and the thermoplastic adhesive is adhered to the connecting substrate via the pressure sensitive adhesive.

15. (original) The surface mount device of claim 14, wherein at least 75% of the thermoplastic adhesive surface area is free of the pressure sensitive adhesive.

16. (original) The surface mount device of claim 1, wherein the bottom surface of the connecting substrate has an array of solder bumps, and the thermoplastic adhesive has a height which is less than the solder bump height.

17. (original) The surface mount device of claim 16, wherein the height of the thermoplastic adhesive is at least 25% and no more than 90% of the solder bump height.

18. (original) The surface mount device of claim 17, wherein the height of the thermoplastic adhesive is 70% or less of the solder bump height.

19. (original) The surface mount device of claim 16, wherein the height of the thermoplastic adhesive is at least 40% of the solder bump height.

20. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a complex viscosity of at least 50 Pa•s, and is a solid or semi-solid at 55°C.

21. (original) The surface mount device of claim 20, wherein the thermoplastic adhesive has a complex viscosity of at least 80 Pa•s, and is a solid at 80°C.

22. (original) The surface mount device of claim 21, wherein the thermoplastic adhesive is a solid or semi-solid at 100°C.

23. (original) The surface mount device of claim 21, wherein the thermoplastic adhesive comprises a functionalized polyolefin.

24. (original) The surface mount device of claim 23, wherein the amount of the functionalized polyolefin is at least 2 wt.%, based on the weight of the thermoplastic adhesive.

25. (original) The surface mount device of claim 23, wherein the amount of the functionalized polyolefin is at least 20 wt.%, based on the weight of the thermoplastic adhesive.

26. (original) The surface mount device of claim 23, wherein the amount of the functionalized polyolefin is at least 40 wt.%, based on the weight of the thermoplastic adhesive.

27. (original) The surface mount device of claim 23, wherein the functionalized polyolefin is functionalized with acid groups, amine groups, or a combination thereof.

28. (original) The surface mount device of claim 23, wherein the functionalized polyolefin is functionalized with a functionalizing agent comprising unsaturated mono- or polycarboxylic acid monomers or the acid derivatives thereof.

29. (previously presented) The surface mount device of claim of claim 28, wherein the functionalizing agent comprises a compound selected from the group consisting of acrylic acid, methacrylic acid, ethylacrylic acid, butylacrylic acid, maleic acid, fumaric acid, tetrahydrophthalic acid, 4-methylcyclohexane-4-en-1,2-dicarboxylic acid, bicyclo(2,2,1)hepta-5-en-2,3-dicarboxylic acid, itaconic acid, crotonic acid, citraconic acid, isocrotonic acid, mesaconic acid, angelic acid, maleic anhydride, crotonic

anhydride, citraconic anhydride, itaconic anhydride, nadic anhydride, nadic methyl anhydride, tetrahydro phthalic anhydride, vinyl acetate, methyl hydrogen maleate, methyl acrylate, methyl methacrylate, ethyl acrylate, ethyl methacrylate, butyl acrylate, butyl methacrylate, glycidyl acrylate, glycidyl methacrylate, monoethyl maleate, diethyl maleate, monomethyl fumarate, dimethyl fumarate, monoethyl itaconate, diethyl itaconate, acrylamide, methacrylamide, maleic monoamide, maleic diamide, maleic N-monoethylamide, maleic N,N-diethylamide, maleic N-monobutylamide, maleic N,N-dibutylamide, fumaric amide, fumaric diamide, fumaric N-monoethylamide, fumaric N,N-diethylamide, fumaric N-monobutylamide, fumaric N,N-dibutylamide, maleimide, N-butylmaleimide, N-phenylmaleimide, sodium acrylate, mono and di-sodium maleate, sodium methacrylate, potassium acrylate, potassium methacrylate, and combinations thereof.

30. (previously presented) The surface mount device of claim 29, wherein the functionalizing agent comprises a compound selected from the group consisting of itaconic acid, acrylic acid, methacrylic acid, ethylacrylic acid, butylacrylic acid, maleic acid, the ester and anhydride derivatives thereof, and vinyl acetate.

31. (previously presented) The surface mount device of claim 30, wherein the functionalizing agent comprises a compound selected from the group consisting of methacrylic acid, acrylic acid, maleic acid and maleic anhydride.

32. (original) The surface mount device of claim 27, wherein the amount of functionalizing agent ranges from 0.05 wt.% to 50 wt.%, based on the weight of the functionalized polyolefin.

33. (previously presented) The surface mount device of claim 23, wherein the functionalized polyolefin comprises a material selected from the group consisting of a random copolymer of ethylene and an unsaturated carboxylic acid and a derivative thereof.

34. (previously presented) The surface mount device of claim 33, wherein the acid or derivative thereof comprises a material selected from the group consisting of methacrylic acid, acrylic acid, maleic acid, maleic anhydride and combinations thereof.

35. (original) The surface mount device of claim 23, wherein the functionalized polyolefin has a density ranging from 0.915 to 0.935 g/cc.

36. (previously presented) The surface mount device of claim 23, wherein the functionalized polyolefin is selected from the group consisting of a copolymer or grafted polymer of one or more alpha olefin monomers having 2-10 carbon atoms and mono- or polyunsaturated carboxylic acids and the derivatives thereof, and optionally comprising carbon monoxide monomer.

37. (original) The surface mount device of claim 23, wherein the functionalized polyolefin comprises an amine functionalized polyolefin.

38. (original) The surface mount device of claim 37, wherein the amine functionalized polyolefin is prepared by reacting an acid functionalized polyolefin with a polyamine compound or by copolymerizing or reacting a polyamine compound with a polyolefin.

39.-61. (cancelled)

62. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a tensile elongation of at least 50%.

63. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a tensile elongation of at least 100%.

64. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a tensile elongation of at least 150%.

65. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a Youngs modulus ranging from 5 MPa to 2000 MPa.

66. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a Youngs modulus ranging from 70 to 300 MPa.

67. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a maximum tensile strength of at least 500 to 15,000 psi.

68. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a maximum tensile strength ranging from 500 to 4000 psi.

69. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive has a complex viscosity of at least 80 Pa•s at any temperature ranging from 140°C to 220°C, and does not exceed 5000 Pa•s at 220°C, as measured in a parallel plate rheometry test at a 1" circular plate gap width of 1mm, and a heat rate of 2°C per minute starting at 140°C, and at a shear rate of 0.1 radians per second, a tensile elongation of at least 50%, a Youngs modulus of less than 2000 MPa at 25°C, and a tensile strength of at least 500 psi.

70. (original) The surface mount device of claim 1, wherein the thermoplastic adhesive is non-electrically conducting.

71.-164. (cancelled)